IN THE CLAIMS:

1. (currently amended) An ultrafiltration system comprising:

   a) a membrane comprising micromachined pores having a length and a width, said length being less than 200 microns and said width being less than 200 nanometers, wherein the ratio of said length to said width is at least 5:1;

   b) a housing containing said membrane, wherein said housing comprises a coating, said coating being biocompatible for *in vivo* use; and

   c) a fluid delivery passageway configured to: i) receive blood or plasma from a subject's vasculature; ii) deliver said blood or plasma across said membrane to generate an ultrafiltered fluid; and iii) deliver said blood or plasma, said ultrafiltered fluid, or combinations thereof to said subject's vasculature.

2. (original) The system of claim 1, wherein said length is less than 100 microns.

3. (original) The system of claim 1, wherein said width is less than 100 nanometer.

4. (original) The system of claim 1, wherein said ratio is at least 10:1.

5. (canceled).

6. (original) The system of claim 1, wherein said system further comprises one or more electrodes positioned on or near said membrane such that an electric field is generated in or near said pores.

7. (previously amended) The system of claim 1, wherein said housing has a length and a width, said length of said housing being less than 300 millimeters and said width of said housing being less than 300 millimeters.

8. (currently amended) An ultrafiltration system compising:

a) a membrane comprising a plurality of micromachined pores, wherein the shortest dimension of each of said plurality of micromachined pores differs from the shortest dimension of the other micromachined pores by no more than 10%;

b) a housing containing said membrane, wherein said housing comprises a coating, said coating being biocompatible for *in vivo* use; and

c) a fluid delivery passageway configured to: i) receive blood or plasma from a subject's vasculature; ii) deliver said blood or plasma across said membrane to generate an ultrafiltered fluid; and iii) deliver said blood or plasma, said ultrafiltered fluid, or combinations thereof to said subject's vasculature.

9. (canceled).

10. (original) An ultrafiltration system comprising:

a) a membrane comprising nanofabricated pores;

b) an electrode positioned on or near said membrane such that an electric field is generated in or near said nanofabricated pores;

c) a housing containing said membrane and said electrode; and

d) a fluid delivery passageway with a first end and a second end, said first end positioned outside of said housing, said second end positioned to deliver fluid across said membrane.

11. (original) The system of claim 10, further comprising a pump configured to pass fluid through said fluid delivery passageway.

12. (original) The system of claim 10, further comprising a nanoscale actuator that decreases protein fouling of said pores.

13. (currently amended) A method of filtering a subject's blood or plasma comprising:

a) providing:

i) a subject having a biological fluid; and

ii) an ultrafiltration system ~~of claim 1~~ comprising:

A) a membrane comprising micromachined pores having a length and a width, said length being less than 200 microns and said width being less than 200 nanometers, wherein the ratio of said length to said width is at least 5:1;

B) a housing containing said membrane; and

C) a fluid delivery passageway configured to: i) receive blood or plasma from a subject's vasculature; ii) deliver said blood or plasma across said membrane to generate an ultrafiltered fluid; and iii) deliver said blood or plasma, said ultrafiltered fluid, or combinations thereof to said subject's vasculature;

b) transferring said biological fluid into said fluid delivery passageway; and

c) passing said fluid across said membrane to generated ultrafiltered fluid; and

d) transferring said ultrafiltered fluid to said subject.

14. (original) The method of claim 13, wherein said filtered fluid is substantially free of proteins.

15. (original) The method of claim 13, wherein an electric field is produced under conditions such that said pores provide a charge and size selective barrier to proteins.

16. (original) The method of claim 15, wherein said electric field is produced under conditions such that protein fouling is reduced in said pores.

17. (original) The method of claim 13, wherein said filtered fluid comprises hemofiltered fluid.

18. (cancelled).

19. (currently amended) An implantable ultrafiltration device comprising:

a) a membrane comprising micromachined pores configured to permit ultrafiltration of blood under systolic blood pressure without the use of a pump;

b) wherein said device further comprises one or more electrodes positioned on or near said membrane such that an electric field is generated in or near said pores;

c) a biocompatible housing containing said membrane; and

d) a fluid delivery passageway configured to: i) receive blood or plasma from a subject's vasculature; ii) deliver said blood or plasma across said membrane to generate an ultrafiltered fluid; and iii) deliver said blood or plasma, said ultrafiltered fluid, or combinations thereof to said subject's vasculature.

20. (canceled).

21. (original) The device of claim 19, wherein said housing has a length and a width, said length of said housing being less than 300 millimeters and said width of said housing being less than 300 millmeters.

22. (original) A diagnostic ultrafiltration device comprising:

a) a membrane comprising a plurality of micromachined pores, wherein the shortest dimension of each of said plurality of micromachined pores differs from the shortest dimension of the other micromachined pores by no more than 10%;

b) a housing containing said membrane;

c) a fluid delivery passageway with a first end and a second end, said first end positioned outside of said housing, said second end positioned to delivery fluid across said membrane and into a chamber enclosed by said housing;

d) a sensor contained in said chamber, said sensor configure to detect an analyte.

23. (original) The device of claim 22, wherein said housing comprises a coating, said coating being biocompatible for *in vivo* use.

24. (original) The device of claim 22, wherein said analyte is selected from the group consisting of glucose, potassium, sodium, calcium, chloride, oxygen, carbon dioxide, and lactic acid.

25. (original) The device of claim 22, wherein said analyte comprises a pathogen or a portion of a pathogen.

26. (original) The device of claim 22, wherein said device further comprises one or more electrodes positioned on or near said membrane such that an electric field is generated in or near said pores.

27. (original) The device of claim 26, wherein said electric field is produced under conditions such that protein fouling is reduced in said pores.

28. (original) A bioartificial ultrafiltration device, comprising:

a) a housing

b) an inlet port passing through said housing, said inlet port configured to receive a biological fluid,

c) an outlet port passing through said housing, said outlet port configured to return a biological fluid to a subject,

d) a membrane contained in said housing, said membrane comprising micromachined pores, and

e) a population of cells attached to said membrane.

29. (original) The device of claim 28, wherein said housing comprises two or more interior chambers.

30. (original) The device of claim 28, wherein said housing is made of a biocompatible material.

31. (original) The device of claim 28, wherein said pores have a length and a width, said length being less than 200 microns and said width being less than 200 nanometers, wherein the ratio of said length to said width is at least 5:1.

32. (original) The device of claim 28, wherein said device further comprises one or more electrodes positioned on or near said membrane such that an electric field is generated in or near said pores.

33. (original) The device of claim 28, wherein said cells are selected from the group consisting of renal tubule cells, pancreatic cells, hepatic cells, thyroid cells, adrenal cells, parathyroid cells, pituitary cells, hypothalamic cells, gonadal cells, prokaryotic cells, duodenal cells, gastric cells, intestinal cells, muscle cells, fibroblast cells, and endothelial cells.

34. (original) The device of claim 28, wherein said housing has physical dimensions that permit said device to be used in a human subject, *in vivo*.

35. (original) The device of claim 28, wherein a membrane prevents passage of cells or components of cells into said outlet port.

36. (currently amended) A bioartificial ultrafiltration device, comprising:

a) a housing

b) an inlet port passing through said housing, said inlet port configured to receive a biological fluid,

c) an outlet port passing through said housing, said outlet port configured to return a biological fluid to a subject,

d) a textured surface contained in said housing, said textured surface configured to support the attachment and differentiation of kidney tissue, and

e) a population of cells attached to said textured surface ~~membrane~~.

37. (original) The device of claim 36, wherein said housing comprises two or more interior chambers.

38. (original) The device of claim 36, wherein said textured surface comprises a silicon surface.

39. (original) The device of claim 38, wherein said silicon surface comprises a single-crystal silicon surface.

40. (original) The device of claim 36, wherein said surface is coated with extracellular matrix proteins.

41. (original) The device of claim 36, wherein said cells are selected from the group consisting of renal tubule cells, pancreatic cells, hepatic cells, thyroid cells, adrenal

cells, parathyroid cells, pituitary cells, hypothalamic cells, gonadal cells, prokaryotic cells, duodenal cells, gastric cells, intestinal cells, muscle cells, fibroblast cells, stem cells, feeder cells, and endothelial cells.

42. (original) The device of claim 41, wherein said renal tubule cells express tight junction proteins.

43. (original) The device of claim 36, wherein said surface is prepared by generating an oxide layer, followed by deposition of a polysilicon film.

44. (original) The device of claim 36, wherein a membrane prevents passage of cells or components of cells into said outlet port.

45. (canceled).